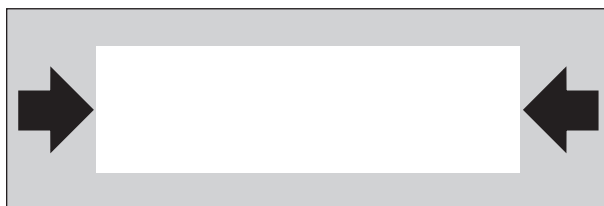
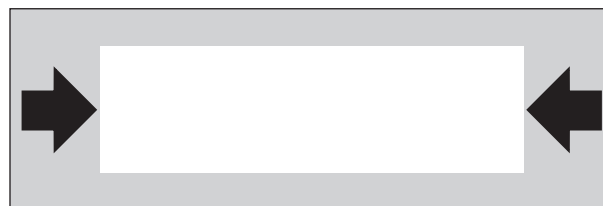


Insert Personal Education Number (PEN) here.



Insert **only** pre-printed PEN label here.



STUDENT INSTRUCTIONS

1. Insert the stickers with your Personal Education Number (PEN) in the allotted spaces above. **Under no circumstance is your name or identification, other than your Personal Education Number, to appear on this booklet.**
2. Ensure that in addition to this examination booklet, you have an **Examination Response Form**. Follow the directions on the front of the Response Form.
3. **Disqualification** from the examination will result if you bring books, paper, notes or unauthorized electronic devices into the examination room.
4. When instructed to open this booklet, **check the numbering of the pages** to ensure that they are numbered in sequence from page one to the last page, which is identified by

END OF EXAMINATION.

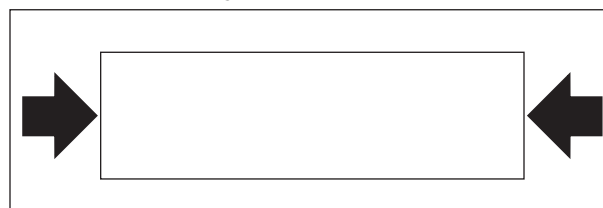
5. At the end of the examination, place your Response Form inside the front cover of this booklet and return the booklet and your Response Form to the supervisor.

PHYSICS 12

JUNE 2000

COURSE CODE = PH

Insert **only** hand-printed PEN here.



Ministry use only.



Question 1:

1. .

(7)

Question 9:

9. .

(4)

Question 2:

2. .

(7)

Question 3:

3. .

(7)

Question 4:

4. .

(9)

Question 5:

5. .

(7)

Question 6:

6. .

(7)

Question 7:

7. .

(7)

Question 8:

8. .

(5)

PHYSICS 12

JUNE 2000

COURSE CODE = PH

GENERAL INSTRUCTIONS

1. Aside from an approved calculator, electronic devices, including dictionaries and pagers, are **not** permitted in the examination room.
2. All multiple-choice answers must be entered on the Response Form using an **HB pencil**. Multiple-choice answers entered in this examination booklet will **not** be marked.
3. For each of the written-response questions, write your answer in the space provided in this booklet. Rough-work space has been incorporated into the space allowed for answering each written-response question. You may not need all of the space provided to answer each question.
4. Ensure that you use language and content appropriate to the purpose and audience of this examination. Failure to comply may result in your paper being awarded a zero.
5. This examination is designed to be completed in **two hours**. *Students may, however, take up to 30 minutes of additional time to finish.*

PHYSICS 12 PROVINCIAL EXAMINATION

- | | Value | Suggested Time |
|---|------------------|--------------------|
| 1. This examination consists of two parts: | | |
| PART A: 30 multiple-choice questions worth two marks each | 60 | 60 |
| PART B: 9 written-response questions | 60 | 60 |
| Total: | 120 marks | 120 minutes |
2. The last **three** pages inside the back cover contain the **Table of Constants, Mathematical Equations, Formulae, and Rough Work for Multiple-Choice**. These pages may be detached for convenient reference prior to writing this examination.
3. **A calculator is essential for the Physics 12 Provincial Examination.** The calculator must be a hand-held device designed primarily for mathematical computations involving logarithmic and trigonometric functions and may also include graphing functions. Computers, calculators with a QWERTY keyboard, and electronic writing pads will not be allowed. Students must not bring any external devices to support calculators such as manuals, printed or electronic cards, printers, memory expansion chips or cards, or external keyboards. Students may have more than one calculator available during the examination. Calculators may not be shared and must not have the ability to either transmit or receive electronic signals. In addition to an approved calculator, students will be allowed to use rulers, compasses, and protractors during the examination.
4. a) Final answers must include appropriate **units**.
b) Marks will not be deducted for answers expressed to **two** or **three** significant figures.
c) In this examination the zero in a number such as 30 shall be considered to be a significant zero.
5. You are expected to communicate your knowledge and understanding of physics principles in a clear and logical manner. Partial marks will be awarded for steps and assumptions leading to a solution. Full marks will **not** be awarded for providing **only** a final answer.

If you are unable to determine the value of a quantity required in order to proceed, you may assume a reasonable value and continue toward the solution. Such a solution, however, may not be eligible for full marks.

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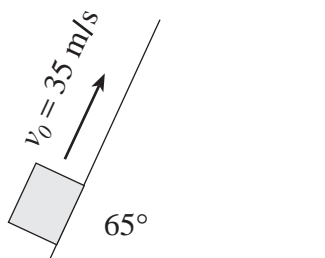
PART A: MULTIPLE CHOICE

Value: 60 marks (2 marks per question)

Suggested Time: 60 minutes

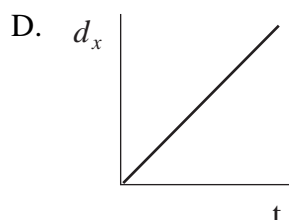
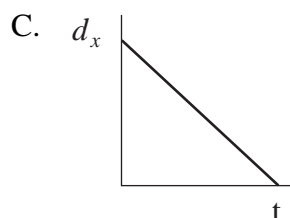
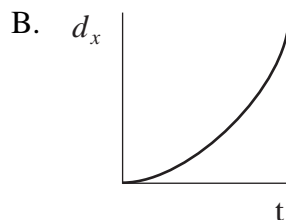
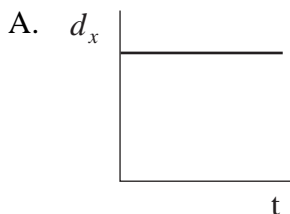
INSTRUCTIONS: For each question, select the **best** answer and record your choice on the Response Form provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

- Which of the following contains scalar quantities only?
 - speed, energy
 - velocity, energy
 - speed, displacement
 - velocity, momentum
- An object is fired up a frictionless ramp as shown in the diagram.



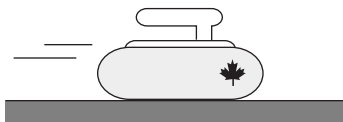
If the initial velocity is 35 m/s , how long does the object take to return to the starting point?

- 3.6 s
 - 3.9 s
 - 7.9 s
 - 17 s
- Which of the following graphs best illustrates the horizontal displacement of a projectile as a function of time? Ignore friction.



4. A constant net force acting on an object results in the object having a constant
- A. velocity.
 - B. momentum.
 - C. acceleration.
 - D. kinetic energy.

5. A curling rock is travelling to the right across the ice as shown in the diagram.



Which of the following best represents the forces acting on the curling rock?

- A. B. C. D.

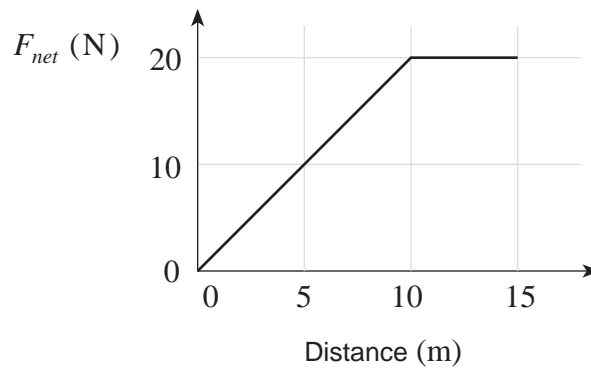
6. A change in kinetic energy is equivalent to

- A. work.
- B. power.
- C. impulse.
- D. momentum.

7. A 16 kg object is dropped from a height of 25 m and strikes the ground with a speed of 18 m/s. How much heat energy was produced during the fall?

- A. 0 J
- B. 1 300 J
- C. 2 600 J
- D. 3 900 J

8. A force is applied to an 8.0 kg object initially at rest. The magnitude of the net force varies with distance as shown.

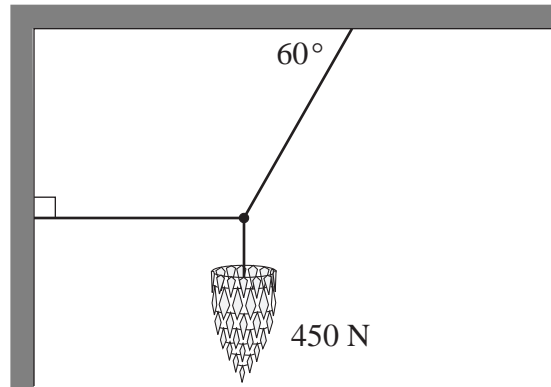


What is the speed of the object after moving 15 m?

- A. 5.0 m/s
 B. 6.1 m/s
 C. 7.1 m/s
 D. 8.7 m/s
9. A machine rated at 1 500 W lifts a 100 kg object 36 m vertically in 45 s. What is the efficiency of this machine?
- A. 0.053
 B. 0.48
 C. 0.52
 D. 0.65
10. Two cars collide head-on and come to a complete stop immediately after the collision. Which of the following is correct?

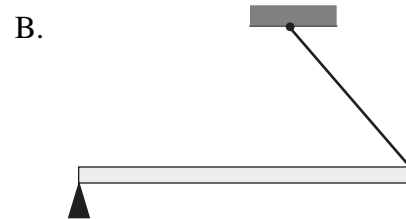
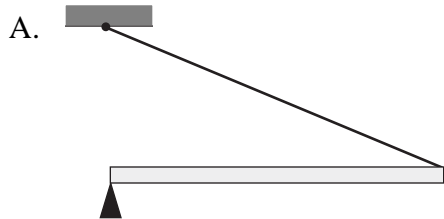
	TOTAL MOMENTUM	TOTAL ENERGY
A.	is conserved	is conserved
B.	is conserved	is not conserved
C.	is not conserved	is conserved
D.	is not conserved	is not conserved

11. A 450 N chandelier is supported by three cables as shown in the diagram.

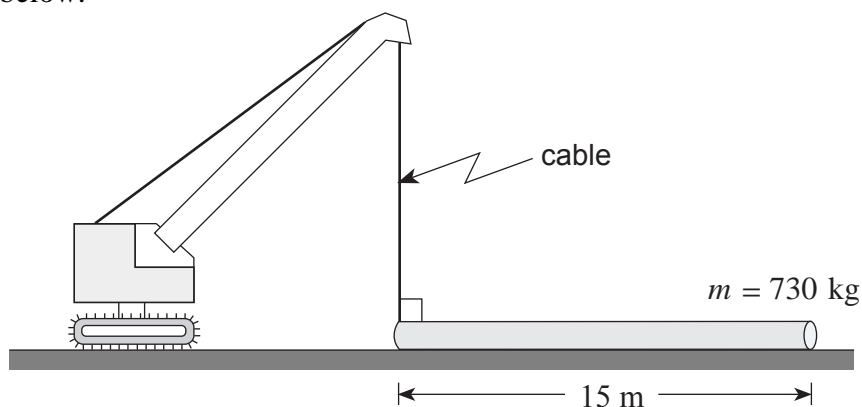


What is the tension in the horizontal cable?

- A. 46 N
B. 260 N
C. 450 N
D. 520 N
12. A beam is to be kept horizontal by a cord. In which of the four situations shown below will the tension in the cord be least?

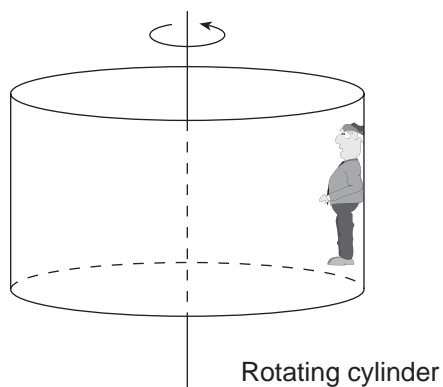


13. A crane is used to lift one end of a uniform 15 m long pipe with a mass of 730 kg as shown in the diagram below.

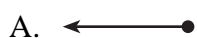


What is the minimum force of tension in the crane cable to just lift the end of the pipe off the ground?

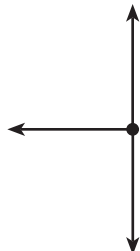
- A. 3.7×10^2 N
 - B. 4.8×10^2 N
 - C. 3.6×10^3 N
 - D. 7.2×10^3 N
14. In a popular amusement park ride, a large cylinder is set in rotation. The floor then drops away leaving the riders suspended against the wall in a vertical position as shown.



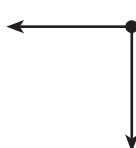
Which of the following is the correct free-body diagram for the person at the position shown?



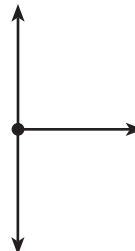
B.



C.



D.

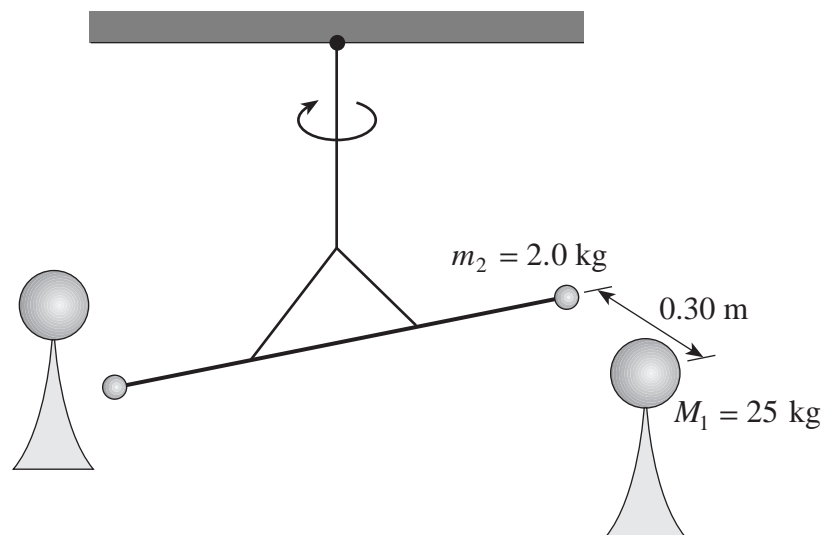


15. A 0.500 kg ball is swung in a horizontal circle of radius 1.20 m with a period of 1.25 s. What is the centripetal force on the ball?
- A. 0.384 N
 B. 15.2 N
 C. 18.9 N
 D. 30.3 N

16. A rock drops from a very high altitude towards the surface of the moon. Which of the following is correct about the changes that occur in the rock's mass and weight?

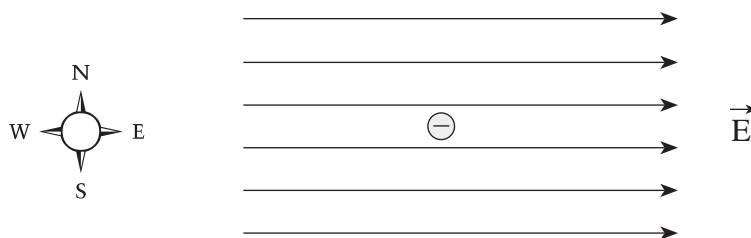
	MASS	WEIGHT
A.	decreases	decreases
B.	decreases	increases
C.	remains constant	decreases
D.	remains constant	increases

17. Cavendish's historic experiment is set up as shown to determine the force between two identical sets of masses. What would be the net force of attraction between **one** set of masses?



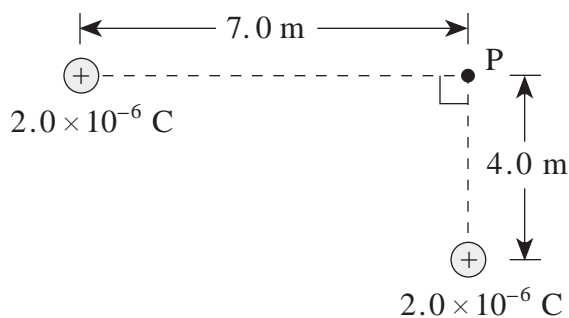
- A. 1.1×10^{-8} N
 B. 1.9×10^{-8} N
 C. 2.2×10^{-8} N
 D. 3.7×10^{-8} N

18. An electron in the electric field has an electric force acting on it in what direction?



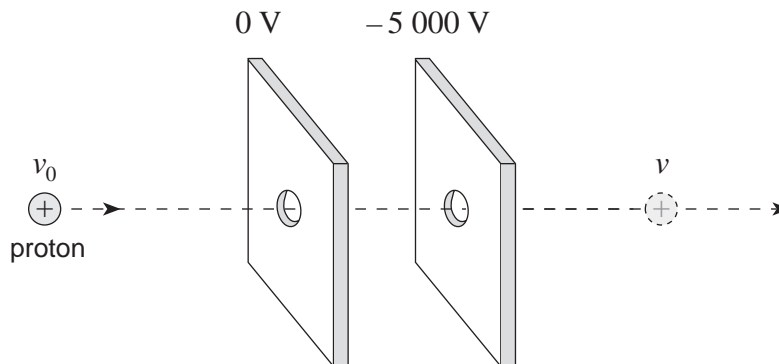
- A. North
- B. South
- C. East
- D. West

19. What is the electric potential at point P due to the two fixed charges as shown?



- A. 1 200 V
- B. 1 500 V
- C. 5 200 V
- D. 7 100 V

20. A moving proton has 6.4×10^{-16} J of kinetic energy. The proton is accelerated by a potential difference of 5 000 V between parallel plates.

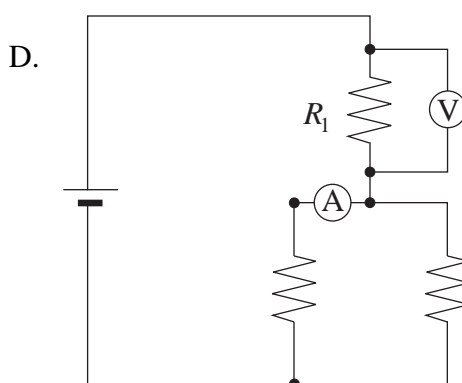
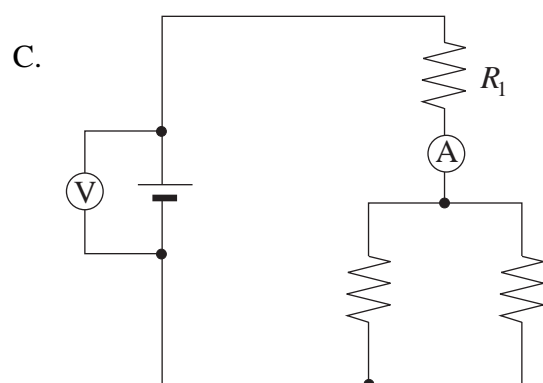
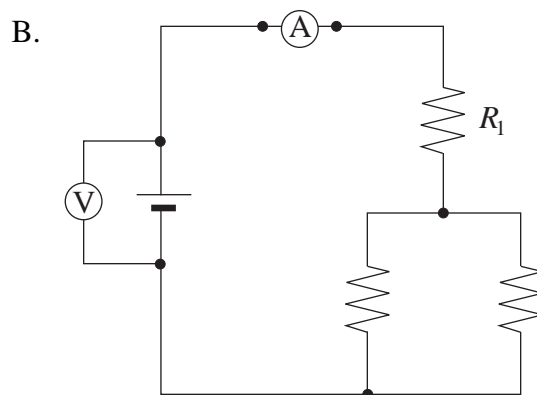
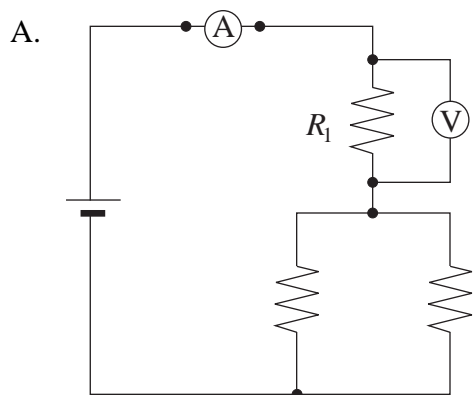


The proton emerges from the parallel plates with what speed?

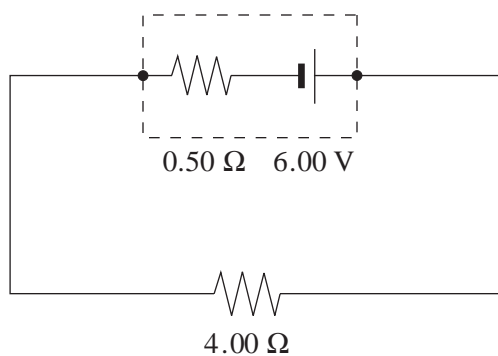
- A. 8.8×10^5 m/s
- B. 9.8×10^5 m/s
- C. 1.3×10^6 m/s
- D. 1.8×10^6 m/s

OVER

21. Which one of the following shows the correct placement of an ammeter and a voltmeter to determine the power output of resistor R_1 ?

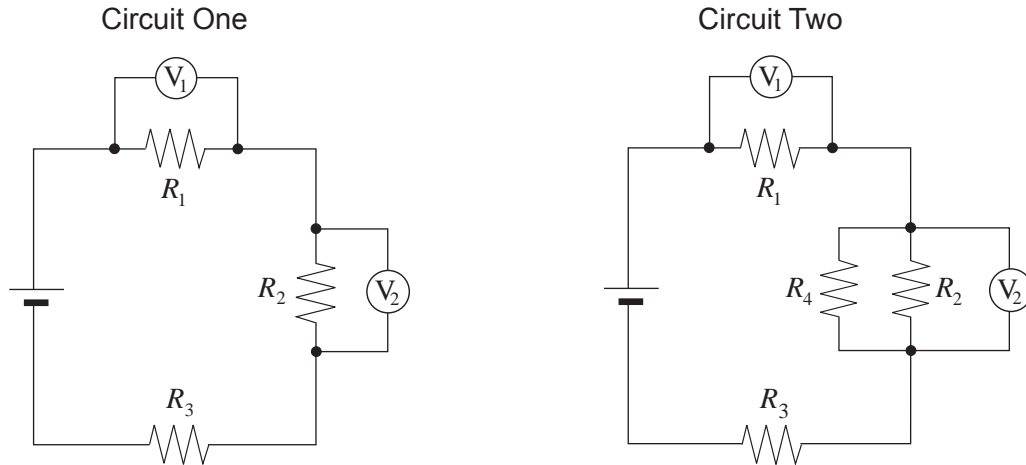


22. What is the terminal voltage of the battery in the circuit shown below?



- A. 5.25 V
 B. 5.33 V
 C. 6.00 V
 D. 6.67 V

23. In circuit one, resistors and voltmeters are connected as shown. In circuit two, an additional resistor R_4 is placed in parallel with resistor R_2 .



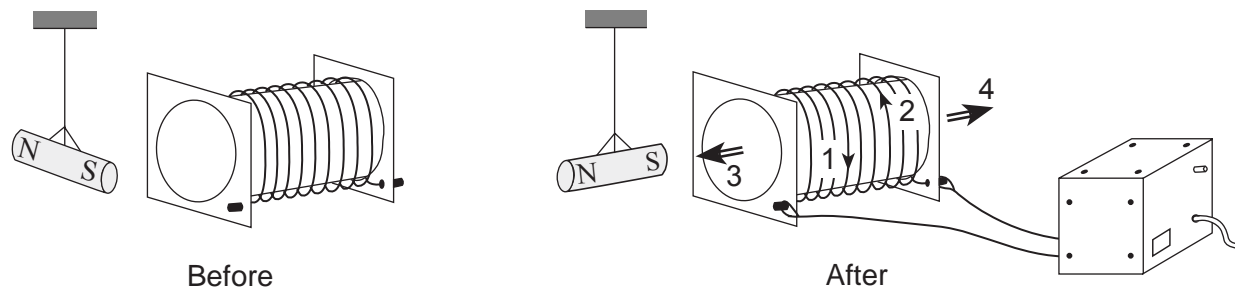
How have the values of V_1 and V_2 in circuit two changed compared to those in circuit one?

	V_1	V_2
A.	no change	decreased
B.	decreased	increased
C.	increased	decreased
D.	increased	no change

24. What are the units of magnetic flux?

- A. T
- B. Wb
- C. $T \cdot m/A$
- D. $N \cdot m/C^2$

25. The diagram shows a magnet suspended near a solenoid. After the solenoid has been connected to a power supply, the magnet rotates to a new position with its south pole pointing towards the solenoid.



Which arrows show the direction of the current in the solenoid and the direction of the magnetic field caused by this current?

	DIRECTION OF CURRENT	DIRECTION OF MAGNETIC FIELD
A.	1	3
B.	1	4
C.	2	3
D.	2	4

26. The diagram shows a conductor between a pair of magnets. The current in the conductor flows out of the page.



In what direction will the magnetic force act on the conductor?

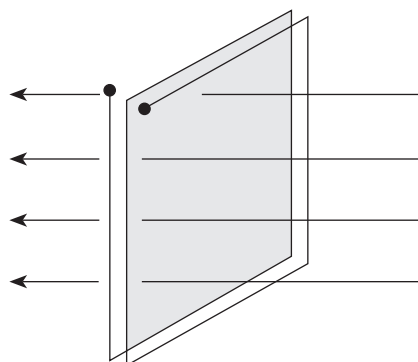
- A. up the page
- B. down the page
- C. towards the left
- D. towards the right

27. A charged particle travels in a circular path in a magnetic field. What changes to the magnetic field and to the velocity of the particle would both cause the radius of its path to decrease?

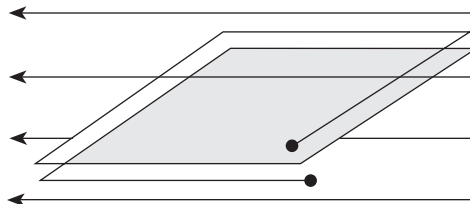
	CHANGE TO THE MAGNETIC FIELD	CHANGE TO THE VELOCITY
A.	increase	increase
B.	increase	decrease
C.	decrease	increase
D.	decrease	decrease

28. The diagram below shows two coils in a magnetic field.

Coils perpendicular to magnetic field



Coils parallel to magnetic field



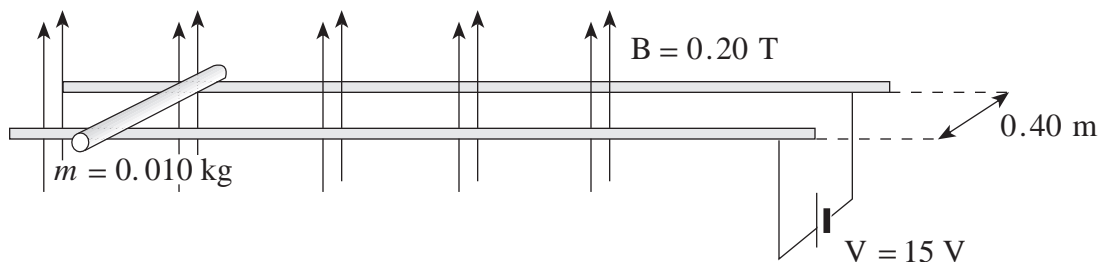
An electric current can be induced in the coil oriented with its plane

- A. parallel to a constant magnetic field.
 B. parallel to a changing magnetic field.
 C. perpendicular to a constant magnetic field.
 D. perpendicular to a changing magnetic field.
29. An electric motor is connected to a 12.0 V power supply. When the armature is prevented from rotating, the current is 8.0 A. When the motor is running at normal speed, the current is 2.0 A. What is the back emf in each case?

	BACK EMF WHEN STATIONARY	BACK EMF WHEN RUNNING
A.	0 V	9.0 V
B.	0 V	3.0 V
C.	12 V	9.0 V
D.	12 V	3.0 V

OVER

30. The diagram shows a 0.010 kg metal rod resting on two long horizontal frictionless rails which remain 0.40 m apart. The circuit has a resistance of $3.0\ \Omega$ and is located in a uniform 0.20 T magnetic field.



Find the initial acceleration and maximum velocity for the rod.

	INITIAL ACCELERATION	MAXIMUM VELOCITY
A.	40 m/s^2	190 m/s
B.	40 m/s^2	300 m/s
C.	120 m/s^2	190 m/s
D.	120 m/s^2	300 m/s

This is the end of the multiple-choice section.
Answer the remaining questions directly in this examination booklet.

PART B: WRITTEN RESPONSE

Value: 60 marks

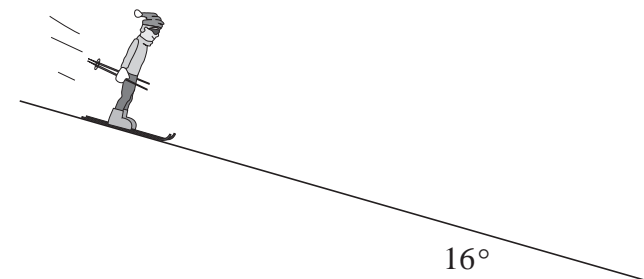
Suggested Time: 60 minutes

INSTRUCTIONS:

1. Rough-work space has been incorporated into the space allowed for answering each written-response question. You may not need all of the space provided to answer each question.
2.
 - a) Final answers must include appropriate **units**.
 - b) Marks will not be deducted for answers expressed to **two** or **three** significant figures.
 - c) In this examination the zero in a number such as 30 shall be considered to be a significant zero.
3. You are expected to communicate your knowledge and understanding of physics principles in a clear and logical manner. Partial marks will be awarded for steps and assumptions leading to a solution.
4. If you are unable to determine the value of a quantity required in order to proceed, you may assume a reasonable value and continue toward the solution. Such a solution, however, may not be eligible for full marks.
5. **Full marks will NOT be awarded for providing only a final answer.**

OVER

1. A 75 kg Olympic skier takes 20 s to reach a speed of 25 m/s from rest while descending a uniform 16° slope.



What is the coefficient of friction between the skis and the slope surface?

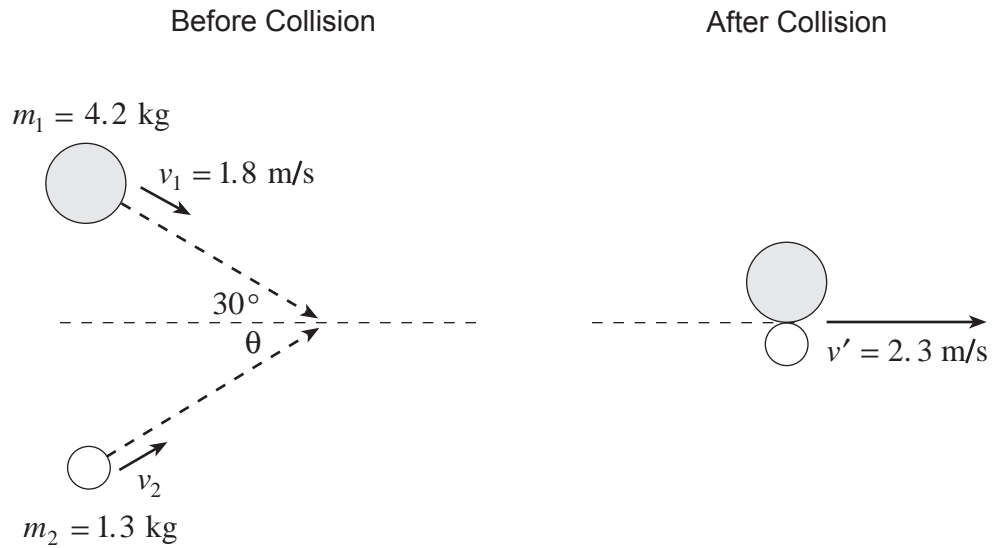
(7 marks)

ANSWER:

coefficient of friction: _____

OVER

2. Two steel pucks are moving as shown in the diagram. They collide inelastically.



Determine the speed and direction (angle θ) of the 1.3 kg puck before the collision. **(7 marks)**

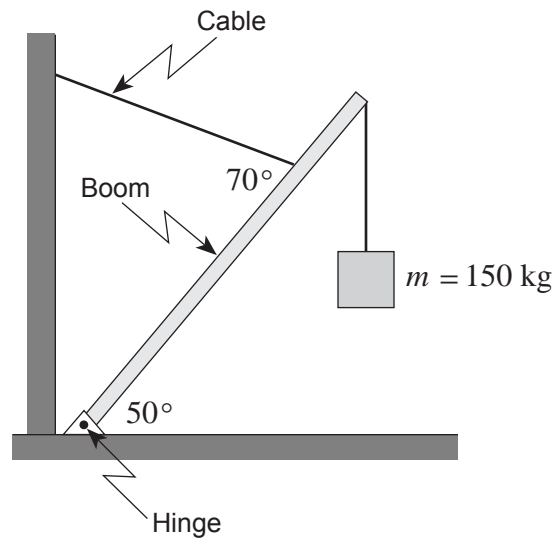
ANSWER:

speed: _____

direction (angle θ): _____

OVER

3. A uniform 6.0 m-long boom has a mass of 55 kg. It is kept in position by a restraining cable attached three-quarters of the way along the boom.



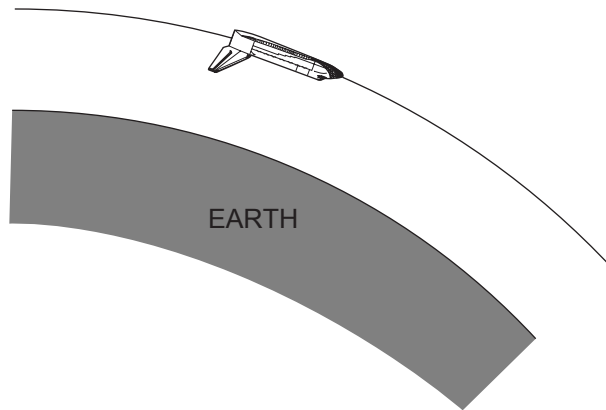
What is the tension in this cable when the boom supports a 150 kg mass as shown? **(7 marks)**

ANSWER:

tension: _____

OVER

4. A space shuttle is placed in a circular orbit at an altitude of 3.00×10^5 m **above** Earth's surface.



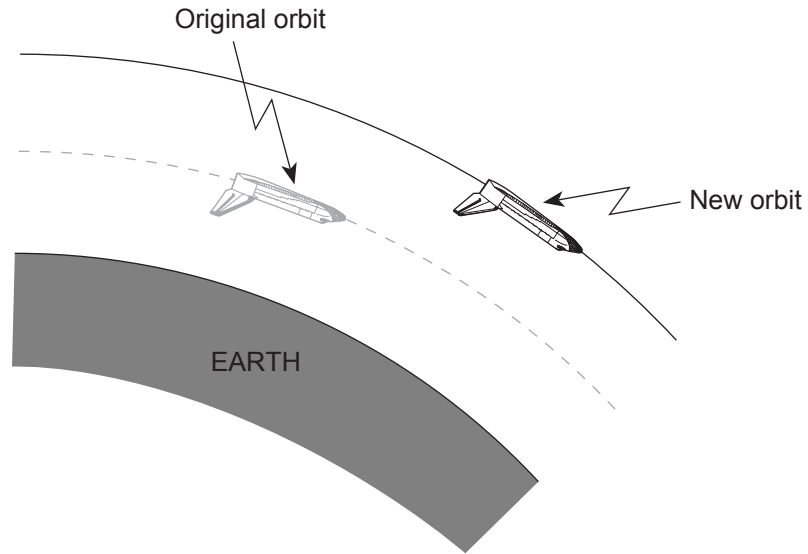
- a) What is the shuttle's orbital speed?

(5 marks)

ANSWER:

a) orbital speed: _____

- b) The space shuttle is then moved to a higher orbit in order to capture a satellite.



The shuttle's speed in this new higher orbit will have to be

- ☐ greater than in the lower orbit.
- ☐ less than in the lower orbit.
- ☐ the same as in the lower orbit.

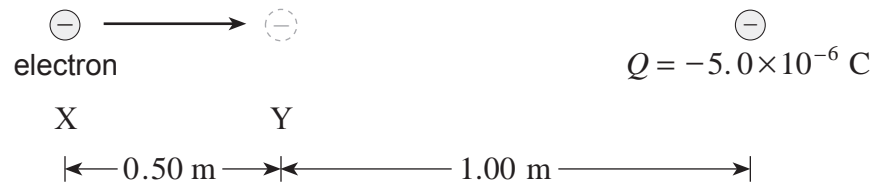
(Check one response.)

(1 mark)

- c) Using principles of physics, explain your answer to b).

(3 marks)

5. a) How much work is done in moving an electron from point X to point Y? **(5 marks)**



ANSWER:

a) work: _____

b) What is the potential difference between point X and point Y?

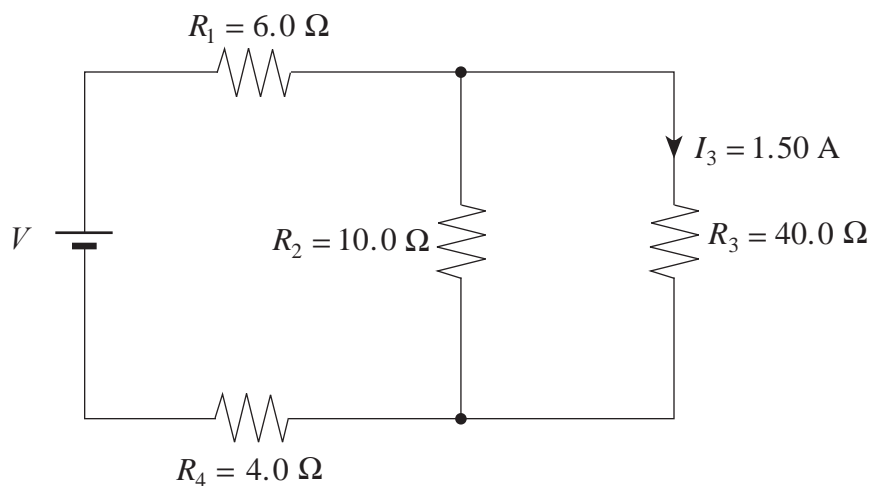
(2 marks)

ANSWER:

b) potential difference: _____

OVER

6. A current of 1.50 A flows through the $40.0\ \Omega$ resistor.



What is the potential difference of the power supply?

(7 marks)

ANSWER:

potential difference: _____

OVER

7. A transformer has 840 primary and 56 secondary windings. The primary coil is connected to a 110 V ac power supply which delivers a 0.30 A current to the transformer.

a) Find the secondary voltage.

(4 marks)

ANSWER:

a) secondary voltage: _____

b) Find the secondary current.

(3 marks)

ANSWER:

b) secondary current: _____

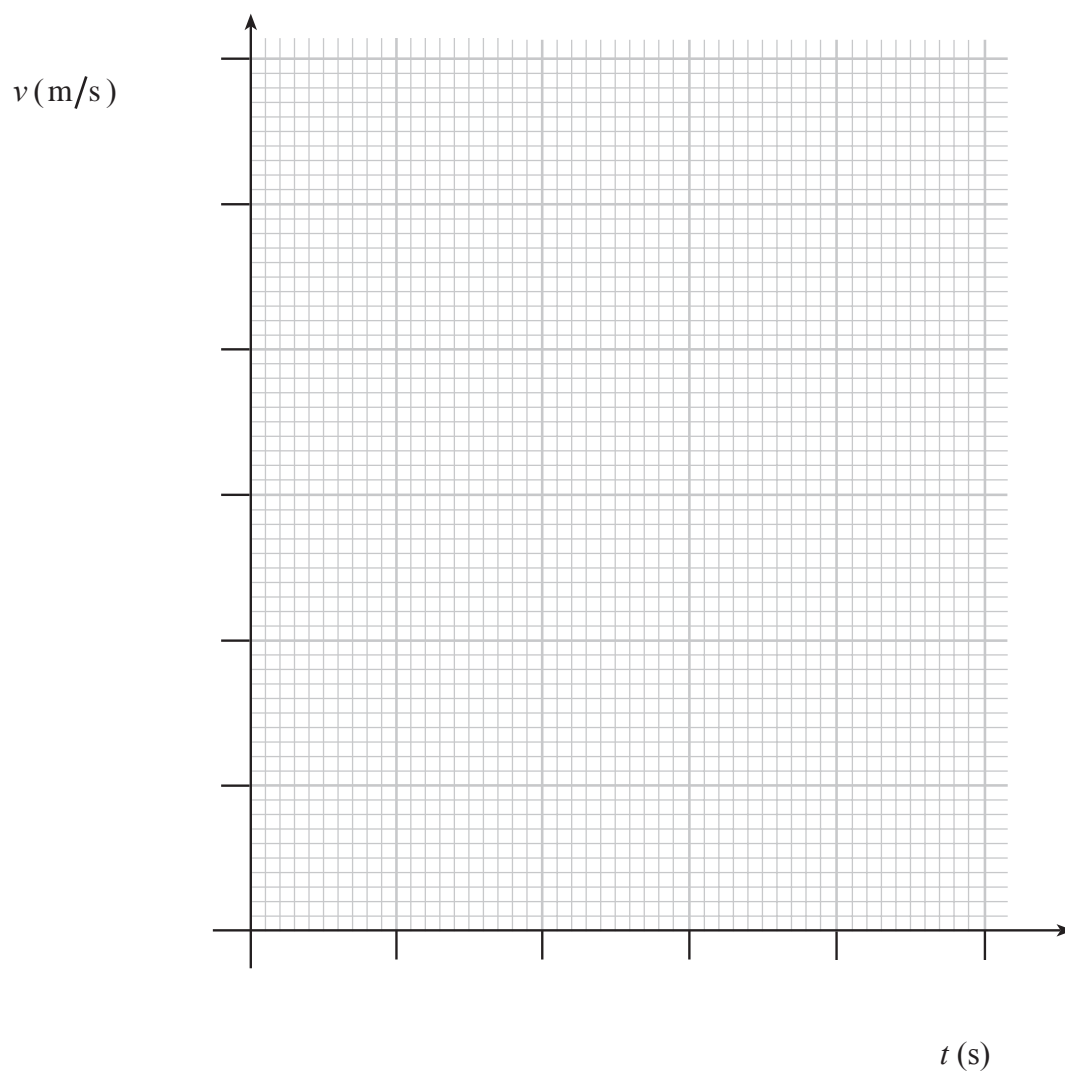
OVER

8. The data table shows the velocity of a car during a 5.0 s interval.

t (s)	0.0	1.0	2.0	3.0	4.0	5.0
v (m/s)	12	15	15	18	20	21

a) Plot the data and draw a best-fit straight line.

(2 marks)



- b) Calculate the area bounded by the graph and the time axis between $t = 0.0 \text{ s}$ and $t = 5.0 \text{ s}$. **(2 marks)**

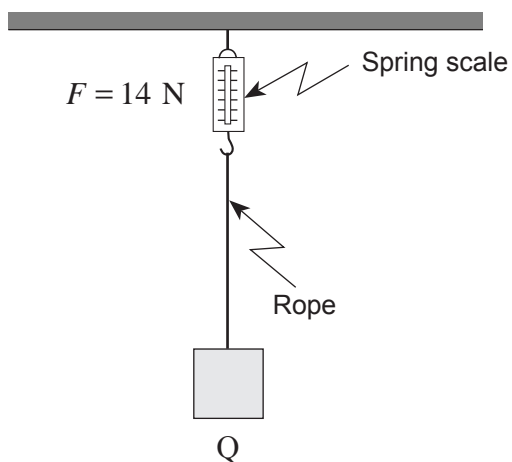
- c) What does this area represent? **(1 mark)**

ANSWER:

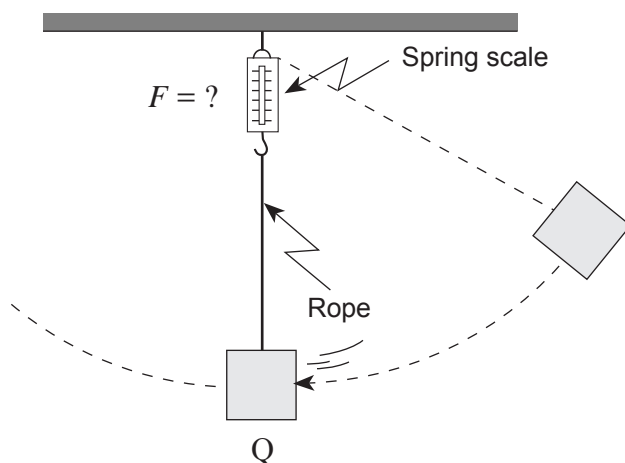
b) area: _____

OVER

9. A mass is suspended by a string attached to a spring scale that initially reads 14 N as shown in Diagram 1.



The mass is pulled to the side and then released as shown in Diagram 2.



As the mass passes point Q, how will the reading on the spring scale compare to the previous value of 14 N? Using principles of physics, explain your answer. **(4 marks)**

END OF EXAMINATION

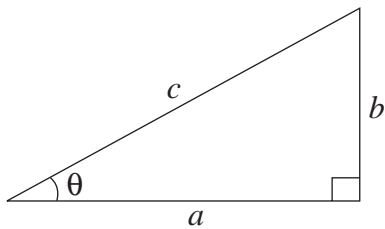
TABLE OF CONSTANTS

Gravitational constant	$G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$
Acceleration due to gravity at the surface of Earth (for the purposes of this examination)	$g = 9.80 \text{ m/s}^2$
Earth	
radius	$= 6.38 \times 10^6 \text{ m}$
radius of orbit about Sun	$= 1.50 \times 10^{11} \text{ m}$
period of rotation	$= 8.61 \times 10^4 \text{ s}$
period of revolution about Sun	$= 3.16 \times 10^7 \text{ s}$
mass	$= 5.98 \times 10^{24} \text{ kg}$
Moon	
radius	$= 1.74 \times 10^6 \text{ m}$
radius of orbit about Earth	$= 3.84 \times 10^8 \text{ m}$
period of rotation	$= 2.36 \times 10^6 \text{ s}$
period of revolution about Earth	$= 2.36 \times 10^6 \text{ s}$
mass	$= 7.35 \times 10^{22} \text{ kg}$
Sun	
mass	$= 1.98 \times 10^{30} \text{ kg}$
Constant in Coulomb's Law	$k = 9.00 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$
Elementary charge	$e = 1.60 \times 10^{-19} \text{ C}$
Mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
Mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
Mass of neutron	$m_n = 1.68 \times 10^{-27} \text{ kg}$
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7} \text{ T} \cdot \text{m/A}$
Speed of light	$c = 3.00 \times 10^8 \text{ m/s}$

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MATHEMATICAL EQUATIONS

For Right-angled Triangles:

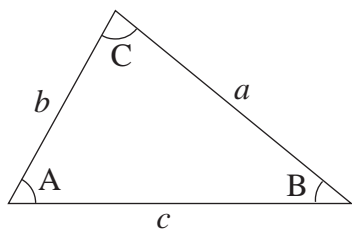


$$a^2 + b^2 = c^2$$

$$\sin \theta = \frac{b}{c} \quad \cos \theta = \frac{a}{c} \quad \tan \theta = \frac{b}{a}$$

$$\text{area} = \frac{1}{2} ab$$

For All Triangles:



$$\text{area} = \frac{1}{2} \text{base} \times \text{height}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\text{Sine Law:} \quad \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$\text{Cosine Law:} \quad c^2 = a^2 + b^2 - 2ab \cos C$$

Circle:

$$\text{Circumference} = 2\pi r$$

$$\text{Area} = \pi r^2$$

Sphere:

$$\text{Surface area} = 4\pi r^2$$

$$\text{Volume} = \frac{4}{3}\pi r^3$$

Quadratic Equation:

$$\text{If } ax^2 + bx + c = 0, \text{ then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Vector Kinematics in Two Dimensions:

$$v = v_0 + at \quad \bar{v} = \frac{v + v_0}{2}$$

$$v^2 = v_0^2 + 2ad \quad d = v_0t + \frac{1}{2}at^2$$

Vector Dynamics:

$$F_{\text{net}} = ma \quad F_g = mg$$

$$F_{\text{fr}} = \mu F_N$$

Work, Energy, and Power:

$$W = Fd \quad E_p = mgh$$

$$E_k = \frac{1}{2}mv^2 \quad P = \frac{W}{t}$$

Momentum:

$$p = mv \quad \Delta p = F\Delta t$$

Equilibrium:

$$\tau = Fd$$

Circular Motion:

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

Gravitation:

$$F = G \frac{m_1 m_2}{r^2} \quad E_p = -G \frac{m_1 m_2}{r}$$

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Electrostatics:

$$F = k \frac{Q_1 Q_2}{r^2} \qquad E = \frac{F}{Q}$$

$$\Delta V = \frac{\Delta E_{\text{p}}}{Q} \qquad E = \frac{\Delta V}{d}$$

$$E_{\text{p}} = k \frac{Q_1 Q_2}{r} \qquad V = \frac{kQ}{r}$$

Electric Circuits:

$$I = \frac{Q}{t} \qquad V = IR$$

$$V_{\text{terminal}} = \mathcal{E} \pm Ir \qquad P = IV$$

Electromagnetism:

$$F = BIl \qquad F = QvB$$

$$B = \mu_0 n I = \mu_0 \frac{N}{l} I \qquad \mathcal{E} = Blv$$

$$\Phi = BA \qquad \mathcal{E} = -N \frac{\Delta \Phi}{\Delta t}$$

$$V_{\text{back}} = \mathcal{E} - Ir$$

$$\frac{V_{\text{s}}}{V_{\text{p}}} = \frac{N_{\text{s}}}{N_{\text{p}}} = \frac{I_{\text{p}}}{I_{\text{s}}}$$

ROUGH WORK FOR MULTIPLE-CHOICE

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ROUGH WORK FOR MULTIPLE-CHOICE